

Application No.: 10/585,078

REMARKS

I. Introduction

In response to the pending final Office Action, Applicants have amended claims 11 and 12 to overcome the § 112 rejections and to further clarify the subject matter of the present disclosure. New claims 13 and 14 have been added. Support for the amendments to claims 11 and 12 may be found, for example, in paragraphs [0026] and [0029] of the specification. Support for new claim 13 may be found, for example, in Tables 8 and 9 of the specification. Support for new claim 14 may be found, for example, in Table 6 of the specification. No new matter has been added.

A Request for Continued Examination (RCE) is being filed concurrently with this Amendment.

Applicants respectfully submit that all pending claims as currently amended are patentable over the cited prior art.

II. The Rejection Of Claims 1-12 Under 35 U.S.C. § 103

Claims 1-6, 9 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yonemura (JP 2003-346888) in view of Ohba et al. (USP No. 5,989,750) and Haruno et al. (JP 08-236101); claim 7 as being unpatentable over Yonemura, Ohba, and Haruno and further in view of Doi et al. (USP No. 4,210,709); and claims 8, 10 and 12 as being unpatentable over Yonemura, Ohba, and Haruno and further in view of Carlisle (USP No. 3,227,583).

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With regard to the present disclosure, independent claims 1 and 10 recite, in part, a lead storage battery including: a negative electrode active material layer which includes Sb, and a separator which includes silica.

Features of the present disclosure include a lead storage battery that includes both a negative electrode active material layer which includes Sb, and a separator which includes silica. As a result of this combination, the corrosion at the tab of the negative electrode is significantly suppressed and the service life of the battery is remarkably improved in the usage mode in which charge and discharge are frequently repeated under a low SOC range.

It is alleged in the Response to Arguments section of the Office Action that Yonemura suggests that its composition, which teaches an Sb content to be within the range of 0.0001 to 0.1 mass %, controls the increase in loss of liquid, cancels the corrosion in the negative electrode and contributes to the life performance. Accordingly, the Examiner alleged that the results from Table 1 of the present disclosure are not unexpected. Applicants vigorously disagree.

Foremost, Test 1 of Yonemura involved testing under overcharge conditions. A constant current charge was repeatedly conducted to check the amount of leakage upon overcharge (see, paragraph [0022] of Yonemura). In Test 2, chargeability after storage in an overdischarged state for a certain period was evaluated (see, paragraph [0025]). These tests are not life tests intended for the usage mode of the present disclosure, in which charge and discharge are frequently repeated at low SOC. Rather, Yonemura intends to solve the problem of corrosion of the tab occurring when the electrolyte decreases due to overcharge and the tab is exposed from the decreased electrolyte (see, paragraph [0004] of Yonemura). As such, Yonemura is directed to

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solving an entirely different problem as the present disclosure. Under low SOC conditions, the battery of Yonemura fails, as discussed below.

As is shown in Table 1 of the present disclosure, unexpected and superior results are shown for batteries having the above-mentioned combination of Sb content AND silica. For example, in battery B4 corresponding to one embodiment of the present disclosure, which has silica content of 35% and Sb content of 0.006%, the corrosion at the tab of the negative electrode grid is significantly suppressed (3.3%) and the service life is remarkably improved (76800 cycles).

In contrast, batteries outside the range which correspond to batteries of the cited prior art do not exhibit superior characteristics. For example, battery A4, which corresponds to a Yonemura battery (silica content 0%, 0.006% Sb), has a corrosion rate of 80.6% and a cycle life of 25,500 cycles. The Sb content of A4 is within the range cited by Yonemura. However, its characteristics are significantly worse than those of battery B4, which also has an Sb content in the range of Yonemura, but also contains silica. This difference is due to the corrosion rate of the tab immersed in the electrolyte in the life test being conducted at low SOC in the present disclosure, but at overcharge conditions in Yonemura. In the life test in which charge and discharge are frequently repeated at low SOC, the corrosion rate of the tab of the battery of Yonemura cannot be suppressed.

Furthermore, there is no teaching or suggestion in Yonemura that the concentration of silica combined with the concentration of Sb results in a battery with significantly improved characteristics during lifetime conditions. As such, it is clear that the presence of both silica and Sb in a battery as recited in claims 1 and 10 produces unexpected, superior results.

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Moreover, Haruno, Ohba and Carlisle fail to remedy this deficiency. As such, it is clear that the proposed combination of references fails to predict or suggest the unexpected results obtained from the claimed disclosure. Accordingly, it is clear that Yonemura, Ohba, Haruno and Carlisle do not render independent claims 1 and 10 of the present disclosure obvious.

III. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1 and 10 are patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

In addition, claim 9 recites a battery in which the negative electrode grid is an expanded grid comprising an expanded mesh retaining said negative electrode active material layer, a frame provided at an upper edge portion of said expanded mesh, and said tab connected to said frame, and a ratio of a height of said tab to a width of said frame is 2.2 to 15.0. In addition, claim 13 recites a battery in which a ratio of a height of said tab to a width of said frame is 7.5 to 12.0.

As is shown in Tables 8 and 9 of the present disclosure, in batteries C3, C18-C20, M3, M18-M20, C3', C18'-C20', M3', and M18'-M20', unexpected results are shown. These batteries feature the characteristics of claims 9 and 13, in which a ratio of a height of said tab to a width of said frame is 2.2 to 15.0, or a ratio of a height of said tab to a width of said frame is 7.5 to 12.0. Yonemura is silent with respect to these features.

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Claims 10 and 14 recite that the mass ratio of the negative electrode active material to the positive electrode active material in said electrode plate pack is 0.7 to 1.3, and 0.82 to 1.08, respectively. Unexpected results for these features are shown in Table 6 of the specification. However, Yonemura, Ohba, Haruno and Carlisle all fail to teach or suggest these unexpected results. Accordingly, Applicants submit that claims 9, 10, 13 and 14 are also patentable for at least these reasons.

IV. Rejection Of Claims 1-4, 6 and 10 Under Nonstatutory Double Patenting Doctrine

Claims 1-4, 6 and 10 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 and 8 of copending U.S. Application No. 10/587,186 to Sugie in view of Haruno et al. (JP 08-236101) and Carlisle (USP No. 3,227,583); and claims 1 and 10 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1 of copending U.S. Application No. 10/587,187 to Sugie in view of Ohba et al. (USP No. 5,989,750), Haruno and Carlisle.

With regard to Application No. 10/587,186, since the rejection is provisional, Applicants respectfully request that the rejection be withdrawn until such time as claims in either application have been indicated to be allowable. As claims are often amended during prosecution, it is possible that the claims determined to be allowable may be patentably distinct from one another. According to PAIR, as of today December 1, 2009, the claims of Application No. 10/587,186 have yet to be allowed. As such, Applicants respectfully request that the double patenting rejection of claims 1-4, 6 and 10 be withdrawn.

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With regard to Application No. 10/587,187, Applicants note that Sugie fails to discuss using silica in the separator. Further, although Ohba may disclose the use of silica, nowhere in any of the cited prior art references discuss the unexpected superior results as discussed above. Accordingly, Applicants submit that the obviousness-type double patenting of claims 1 and 10 over claim 1 of Sugie in view of Ohba, Haruno and Carlisle is improper. As such, Applicants respectfully request that the double patenting rejection of claims 1 and 10 be withdrawn.

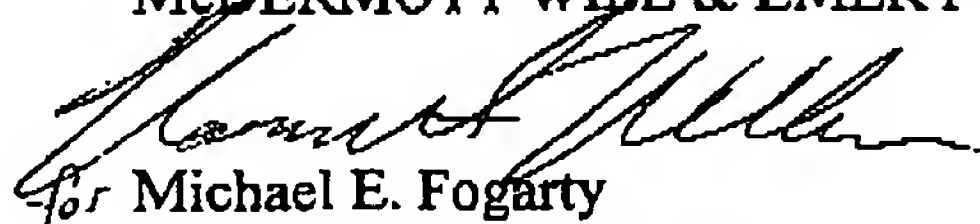
V. Conclusion

Having responded to all open issues set forth in the Office Action, it is respectfully submitted that all claims are in condition for allowance.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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